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AN 1989-155241 [21] WPIDS
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TI **Sputtering** clad **target** material - comprises **target** material clad through metal bonding agent to **copper** substrate contg. e.g. cadmium, iron etc..
DC M13 U11
PA (TANI) TANAKA KIKINZOKU KOGYO KK
CYC 1
PI JP 01096376 A 19890414 (198921)* 3p
ADT JP 01096376 A JP 1987-251177 19871005
PRAI JP 1987-251177 19871005
AB JP 01096376 A UPAB: 19930923
A **sputtering** clad **target** material comprises **target** material clad through metal bonding agent to a more than 99.7% purity **Cu** substrate including at least one of Cd, Fe, Co, Ni, Ti, W, V, Si, Zr, Bi, Ga, Ge, Pt, Pd,Rh, Ru, Ir, Os, Au and **Ag** 100-3,000 ppm in total. Substrate contacting backing plate is prevented from being pressure-bonded.
1-3/3

[Translation]

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(54) **Name of Invention:** Clad Target Material for Sputtering

(21) **Application No.:** Patent Application Sho.62-251177

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Specifications

1. **Name of Invention:** Clad Target for Sputtering

2. **Scope of Patent Application**

A clad target material for sputtering which--in a clad target material for sputtering consisting of target material joined to a copper substrate—is characterized by the substrate copper's purity being at least 99.7% pure and one or more of the metals Cd, Fe, Co, Ni, Ti,, W, V, Si, Zr, Bi, Ga, Ge, Pt, Pd, Rh, Ru, Ir, Os, Au or Ag being added for a total of 100~3,000ppm by weight.

3. **Detailed Explanation of Invention**

Field for Commercial Utilization: This invention relates to clad target material for the sputtering method used as a thin-film forming technique in various industrial fields for forming thin film elements, electrodes, wiring, etc.

Usual Technology and Its Problems: The usual sputtering target material is used by joining it to a metal backing plate with a bonding agent. However, with this method of use, separating the target material from the backing plate to change it is difficult, so that much time is spent on such changing and much care is needed so as not to contaminate the sputtering device's vacuum chamber with part of the coolant fluid that cools target materials on the packing plate side. Such are the very troublesome operating stages needed.

So, we thought of not joining the target material to the packing plate with bonding material, but instead—as shown in Figure 1—holding target material 1 in direct contact with packing plate 3 with attaching jig 2. In such case, to increase the cooling effect for target material 1 with the backing plate, we use metal bonding material 5 to join high-purity copper substrate 4, with its fine heat transmissivity, to the target material's backing plate to make clad target material 6. As shown in Figure 3, we then use circular attaching jig 2 to put its copper substrate 4 into tight contact. However, with backing plates made of copper there has been the problem that, during use, backing plate 3 and copper substrate 4 of clad target material 6 are pressed tightly together and after use are difficult to separate from backing plate 3.

Purpose of Invention: This invention is one devised so as to resolve the above-noted problems, and having the purpose of providing clad target material for sputtering which will not thermally bond the copper substrate to the backing plate during use, but can be easily separated from the backing plate after use.

Means to Resolve the Problems: This invention's technical means for resolving the above-noted problems is characterized by not stinting on the high purity of the clad target material's copper, i.e., making the purity of substrate copper 99.7% or more, and by adding one or more of the metals Cd, Fe, Co, Ni, Ti, W, V, Si, Zr, Bi, Ga, Ge, Pt, Pd, Rh, Ru, Ir, Os, Au or Ag for a total of 100~3,000ppm by

weight.

Effects: Clad target material for sputtering made up as described above has a purity of its copper substrate at 99.7% or better so that the cooling effect from the backing plate is sufficient due to its good heat transmissivity. Also, because one or more of the above described metals has been added at 100~3,000ppm by weight to the copper substrate, so that not only is dispersion of the copper checked but also its recrystallizing temperature has risen, eliminating thermal adhesion with the backing plate during use. The reason for making the added amount of the above-described metal 10~3,000ppm by weight is that at less than 100ppm it cannot prevent thermal adhesion with the backing plate, and beyond 3,000ppm its heat transmissivity becomes poor, lowering its cooling effect.

Application Example: We will explain an application example of this invention's clad target material for sputtering, along with a usual example.

With indium metal-bonding material 5,we joined iridium target material 152.0mm in diameter and 1.0mm thick to the 152.0mm-diameter copper substrate 4.0mm thick shown in Figure 2 and consisting of the component materials shown in the left column of the table below, thus yielding the clad target material for sputtering.

By holding 10 each of these target materials 6 on a copper backing plate, as shown in Figure 3, in round attaching jigs 2 (6.0mm thick, 170mm outer diameter and 153mm inner diameter) having a bracket-shaped cross section and made of SUS 304 and attaching each by screws at eight places around the circumference, each of the clad target materials 6 adheres tightly against backing plates 3. They are set at the anode in the vacuum chamber of a sputtering device not shown in the figure while sputtering is done for three hours at 1KW of DC current to form iridium film on the substrate on the cathode. When we checked on whether or not clad target material 6 was adhering to backing plate 3, we got the results shown in the right column of the following table.

Components of Cu Substrate

	Cu(%)	Added metal(ppm)	No. adhering to Backing Plate
Appl. Exmpl 1	99.9	CD 300	0
" " 2	99.9	Fe 500	"
" " 3	99.8	Co 400, Ni 1,000	"
" " 4	99.9	Ti 200	"
" " 5	99.9	W 400	"
" " 6	99.8	V 300, Ni 300	"
" " 7	99.9	Si 300	"
" " 8	99.9	Zr 300	"
" " 9	99.9	W 100, Si 400	"
" " 10	99.8	Bi 500	"
" " 11	99.9	Ga 400	"
" " 12	99.7	Ge 1,000	"
" " 13	99.9	Pt 200	"
" " 14	99.8	Pd 500	"
" " 15	99.8	Rh 400, Ru 600	"
" " 16	99.7	Ir 1,000, Os 300	"
" " 17	99.7	Au 1,000, Ag 400	"
Usual case 1	99.8	30ppm or less of Pb, P, Se, S & Hg as impurities	9
Usual case 2	99.9	10ppm or less of Pb, P, Se,S & Hg as impurities	7

As is clear from the above table, we found that clad target materials 6 of usual cases 1 and 2 had adhered to backing plate 3, 9 out of 10 times and 7 out of 10 times, respectively, in the sputtering machine. We were unable to remove adhered clad target materials 6 from the backing plate and so also could not remove and change them. On the other hand, none of the application examples' clad target materials had adhered to backing plate 3. Because we had added a total of 100~3,000ppm by weight of one or more of Sn, In, Cd, Mn, Fe, Co, Ni, Ti, W, V, Si, Zr, Bi, Ga, Ge, Pt, Pd, Rh, Ru, Ir, Os, Au and Ag as a single layer on clad target material 6's copper substrate 4, that alone had prevented thermal adhesion to copper substrate 4's backing plate 3.

Effectiveness of Invention: As will be understood from the above explanation, the clad target material for sputtering from this invention had been made with a copper substrate of 99.7% or higher purity, so that it has good thermal transmissivity and cooling from the backing plate side was done with good efficiency.

Also, since we added a total of 100~3,000ppm by weight of one or more of Sn, In, Cd, Mn, Fe, Co, Ni, Ti, W, V, Si, Zr, Bi, Ga, Ge, Pt, Pd, Rh, Ru, Ir, Os, Au and Ag as a single layer on clad target material 6's copper substrate 4, this had the effect not only of deterring the diffusion of copper but also of raising its recrystallizing tempera-ture, so that there would be no thermal adhesion with the backing plate during use and we could easily remove it from the backing plate after use.

4. Simple Explanation of Figures

Figure 1 is a cross-sectional diagram showing how the usual target material for sputtering attaches to the backing plate. Figure 2 is a cross-sectional diagram showing clad target material for sputtering. Figure 3 is a cross-sectional diagram showing how Figure 2's clad target material attaches to a backing plate.

Applicant: Tanaka Precious Metal Industries, Ltd.

1 ... Target material
2 ... Copper substrate
3 ... Clad target material